

## WHAT IS CLAIMED IS:

1. A universal mandrel comprising:  
a core mandrel having an outside diameter;  
at least one adapter sleeve having an inside diameter sized to engage the core mandrel outside diameter; and  
an interlocking mechanism secured between the core mandrel and the at least one adapter sleeve, the interlocking mechanism preventing the at least one adapter sleeve from rotating relative to the core mandrel.
2. A universal mandrel according to claim 1, wherein the interlocking mechanism comprises a lug formed on either the outside diameter of the core mandrel or the inside diameter of the adapter sleeve, and a slot formed in the other of the outside diameter of the core mandrel or the inside diameter of the adapter sleeve, the lug engaging the slot when the adapter sleeve is fitted to the core mandrel.
3. A universal mandrel according to claim 2, wherein the lug is formed on the inside diameter of the adapter sleeve, and wherein the slot is formed in the outside diameter of the core mandrel.
4. A universal mandrel according to claim 1, wherein the interlocking mechanism comprises a flange formed on one edge of the adapter sleeve, the flange having an opening therein, and a connector sized to fit in the opening and secure the flange to an axial face of the core mandrel.

5. A universal mandrel according to claim 4, wherein the connector comprises a pin or a bolt.

6. A universal mandrel according to claim 1, wherein the adapter sleeve is structurally configured to serve as an interface connection with another metallic component.

7. A universal mandrel according to claim 1, wherein the adapter sleeve is structurally configured to serve as an intermediate expansion rate medium to buffer a thermal mismatch between a composite component and an interfaced metallic component.

8. A universal mandrel according to claim 1, comprising a plurality of adapter sleeves of varying exterior dimensions.

9. A universal mandrel according to claim 1, wherein the adapter sleeve is constructed of tool steel.

10. A universal mandrel comprising:  
a core mandrel having an outside diameter;  
at least one adapter sleeve having an inside diameter sized to engage the core mandrel outside diameter; and

an interlocking mechanism secured between the core mandrel and the at least one adapter sleeve, the interlocking mechanism preventing the at least one adapter sleeve from rotating relative to the core mandrel,

wherein a thermal expansion rate of the adapter sleeve is lower than that of the core mandrel.

11. A universal mandrel according to claim 10, wherein the interlocking mechanism comprises a lug formed on either the outside diameter of the core mandrel or the inside diameter of the adapter sleeve, and a slot formed in the other of the outside diameter of the core mandrel or the inside diameter of the adapter sleeve, the lug engaging the slot when the adapter sleeve is fitted to the core mandrel.

12. A universal mandrel according to claim 11, wherein the lug is formed on the inside diameter of the adapter sleeve, and wherein the slot is formed in the outside diameter of the core mandrel.

13. A universal mandrel according to claim 10, wherein the interlocking mechanism comprises a flange formed on one edge of the adapter sleeve, the flange having an opening therein, and a connector sized to fit in the opening and secure the flange to an axial face of the core mandrel.

14. A universal mandrel according to claim 13, wherein the connector comprises a pin or a bolt.

15. A universal mandrel according to claim 10, comprising a plurality of adapter sleeves of varying exterior dimensions.

16. A universal mandrel according to claim 10, wherein the adapter sleeve is constructed of tool steel.